Time, Space, and Pattern in Embryonic Development

MBL Lectures in Biology, Volume 2

Edited by W. Jeffery and R. Raff

Alan R. Liss; New York, 1983
395 pages. $58.00

There are two main ways in which spatial patterns of cellular differentiation can develop. One is by mechanisms involving cell-to-cell interactions specifying the pattern. The other depends on the pattern being largely specified within the egg, this pattern becoming expressed as development proceeds. It is mainly the latter process with which this excellent volume is concerned. The essays deal essentially with eggs and with the early development of spatial organisation. This is not to say that cellular interactions are ignored, but rather that the emphasis is on the role of cytoplasmic organization in early development. There is also considerable emphasis on the application of the new techniques of molecular biology.

There are several papers on sea urchin development. These range from the results of fusing fertilised and unfertilised eggs, through the early pattern of protein synthesis – maternal histone, mRNA expression, to the study of specific genes expressed in the ectoderm. There are intriguing new studies on mRNA localization in sea urchin embryos that open up a whole new approach to development. Parallel studies are represented on the use of monoclonal antibodies to localize particular antigens. Remarkably, a rabbit anti-mouse antibody reacts with cytoplasmic components specific to germ-line precursor cells in nematode embryos. In a way all this could be viewed merely as molecular anatomy, but it offers much more than that. It offers, in the long run, the possibility of finding out which molecules are the cause, as distinct from the results of developmental processes.

Together with these new approaches there has been a revitalisation of old and classic problems. For example what determines the pattern of cleavage in early embryos, and how important is this for pattern formation? There is an intriguing model on the redistribution of maternal messenger RNA by the cytoskeletal framework that leads to the localization of the future muscle cells in ascidian eggs. Equally intriguing is the analysis of the control of polarity in the amphibian egg which is discussed in terms of axial determinants and cell-to-cell interactions. The list of good articles goes on. The early development of the mammal too must be understood in terms of both cytoplasmic localisation, cell polarity, and cell-to-cell interaction.

Insect embryos provide excellent material for embryological studies, particularly since there is the tremendous genetic background for *Drosophila*. Studies on mutants have suggested that there is some sort of determinant in the cytoplasm responsible for establishing the main axes of the embryo. These studies are supported by experimental manipulation of the embryos but the nature of the determinants is still elusive. However, the products of the relevant genes are now becoming available and this offers the most exciting future. The greatest promise seems to lie with homeotic mutants such as the antennapaedia complex.

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